

## REMARKS

### I. Status and Disposition of the Claims

Claims 48-94 are pending. No claims are amended or cancelled herein.

Applicants respectfully acknowledge the examiner's withdrawal of the prior rejection of claims 48, 50-60, 67, 68, 79, 80, 88, 91, and 94 under 35 U.S.C. § 102(b).

### II. Response to Claim Rejections

#### A. § 103(a) rejection of claims 48-80, 83-88 and 90-94

The Examiner rejects claims 48-80, 83-88 and 90-94 under 35 U.S.C. § 103(a) as allegedly unpatentable over Japanese Publication No. JP 2000-086824 ("Sumiyoshi"), in view of "Escorez, Hydrocarbon Tackifier Resins"; ExxonMobil Chemical, August 2001 ("the Exxon reference"); Hawley's Condensed Chemical Dictionary, page 819 (1997) ("Hawley's 819"); and U.S. Patent No. 5,498,735 ("Takeuchi"). Office Action, pages 2-6. Applicants respectfully disagree for at least the following reasons.

##### i. Claims 48, 88, and 94

With respect to claims 48, 88, and 94 (the pending independent claims), the Examiner alleges that Sumiyoshi discloses a tire construction formed of a composition comprising a diene-based rubber, a modified paraffin wax, and an olefin resin, wherein the olefin resin can be "Escorez 1102." See Office Action at 2. The Examiner acknowledges, however, that Sumiyoshi is silent with respect to the claimed "at least one polymer of at least one C<sub>3</sub>-C<sub>24</sub> α-olefin." See *id.*; claim 1. The Examiner therefore maintains that Sumiyoshi discloses each and every element of the present claims, with

the exception of the claimed component (c), which comprises the aforementioned at least one  $\alpha$ -olefin polymer. Office Action at 2.

To correct the deficiencies of Sumiyoshi, the Examiner asserts that:

... one of ordinary skill in the art at the time of the invention would have found it obvious to form the olefin of Sumiyoshi as an alpha olefin since it represents one of the most common, if not the most common, form of an olefin resin.

*Id.* In support of this argument, the Examiner notes that Hawley's 819 "includes a description of an alpha olefin under the definition of 'olefin,'" and that "Takeuchi recognizes the common use of alpha olefins when forming similar material additives (plasticizers, surface active agents) (Column 1, Lines 5-15)." *Id.* From this, the Examiner alleges that "[t]hese references clearly suggest that one of ordinary skill . . . would have found the general language of Sumiyoshi as including alpha olefins[,]" emphasizing that "'alpha olefins' represent one of the most common, if not the most common, structure of olefin resins and applicant has not provided a conclusive showing of unexpected results." *Id.* at 2-3. Further, the Examiner argues that "[i]t is particularly noted that applicant even recognizes the limited number of possibilities for the location of the C=C double bond . . . given such a limited construction and the well known and common use of alpha olefin resin systems, one of ordinary skill in the art at the time the invention was made would have found it obvious to form the olefin resin system of Sumiyoshi as an alpha olefin resin system." *Id.* at 6-7.

Applicants respectfully disagree with and traverse this rejection for at least the following reasons.

Several basic factual inquires must be made in order to determine the obviousness or non-obviousness of claims of a patent application under 35 U.S.C. § 103. These factual inquiries, set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 U.S.P.Q. 459, 467 (1966), require the Examiner to:

- (1) Determine the scope and content of the prior art;
- (2) Ascertain the differences between the prior art and the claims in issue;
- (3) Resolve the level of ordinary skill in the pertinent art; and
- (4) Evaluate evidence of secondary considerations.

The obviousness or non-obviousness of the claimed invention is then evaluated in view of the results of these inquiries. *Graham*, 383 U.S. at 17-18, 148 U.S.P.Q. at 467; see also *KSR Int'l Co. v. Teleflex Inc.*, 82 U.S.P.Q.2d 1385 (U.S. 2007).

Thus, in order to satisfy the initial burden of establishing a *prima facie* case of obviousness, the Examiner must first show that the prior art references teach or suggest all the claim limitations. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974). The Examiner must also show that there is some suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to modify or combine the references. *In re Rouffet*, 149 F.3d 1350, 47 U.S.P.Q.2d 1453 (Fed. Cir. 1998).

The Supreme Court, in the recent *KSR* case, recognized that a showing of "teaching, suggestion, or motivation" could provide helpful insight in determining whether the claimed subject matter is obvious under Section 103(a). See *KSR Int'l Co. v. Teleflex Inc.*, 82 U.S.P.Q.2d 1385 (U.S. 2007). In addition, the Supreme Court mandated that "[t]o facilitate review, this analysis [of whether there was an apparent

reason to combine the known elements in the fashion claimed by the patent at issue] should be made explicit." *Id.* (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness").

Following the *KSR* decision, the Office issued a memorandum to its technology center directors on May 3, 2007, indicating that "**in formulating a rejection under 35 U.S.C. § 103(a) based upon a combination of prior art elements, it remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed.**" (Emphasis in original).

In the present case, a fair reading of the cited references reveals that there is no factual or legal basis for the Examiner's assertion that one of ordinary skill in the art would have found it obvious to modify Sumiyoshi so as to include an  $\alpha$ -olefin polymer within the purview of the present independent claims.

In support of this position, Applicants note that the cited references, alone or in combination, fail to teach or suggest each and every element of claims 48, 88, and 94. See M.P.E.P. § 2143 ("To establish a *prima facie* case of obviousness . . . the prior art reference (or references when combined) must teach or suggest all the claim limitations). In particular, the cited references fail to disclose an elastomeric composition comprising "at least one polymer of at least one C<sub>3</sub>-C<sub>24</sub>  $\alpha$ -olefin," as claimed. See claims 48, 88, and 94.

As admitted by the Examiner, Sumiyoshi and the Exxon reference are “completely silent” with respect to the claimed  $\alpha$ -olefin component. See Office Action, page 2 (“the references are completely silent as to whether the olefin resin system of Sumiyoshi is an alpha olefin resin system”). In fact, Sumiyoshi merely refers to “olefin system resins” and the Exxon reference merely teaches that the Escorez 1102 is derived from “olefins” AND “diolefins.” Applicants respectfully submit that silence as to a claim element cannot be considered as teaching or suggesting that claim element. See *In re Dembiczkak*, 175 F.3d 994, 999 (Fed. Cir. 1999) (explaining that the motivation to combine may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved but must still be supported by actual evidence that is “clear and particular”). Thus, it is clear that Sumiyoshi and the Exxon reference do not teach or suggest each and every element of claims 48, 88, and 94.

Hawley’s ‘819 and Takeuchi do not cure the deficiencies of Sumiyoshi and Exxon Chemical for at least the following reasons.

With respect to Hawley’s ‘819, Applicants acknowledge that this reference describes  $\alpha$ -olefins in the definition of the term “olefin.” See Hawley’s ‘819 at page 819. Applicants submit, however, that this discussion merely acknowledges that  $\alpha$ -olefins are a subgenus of the broad class of chemical compounds known as olefins. In effect, Hawley’s ‘819 discloses no more than Sumiyoshi and the Exxon reference.

It is well established that the Examiner cannot basis an obviousness rejection solely on the fact that prior art discloses a broad class of compounds, here “olefins,” that is well known to encompass a subgenus, here “ $\alpha$ -olefins.” It has been repeatedly held

that “[t]he fact that a claimed species or subgenus is encompassed by a prior art genus **is not sufficient by itself** to establish a *prima facie* case of obviousness. *In re Baird*, 16 F.3d 380, 382, (Fed. Cir. 1994) (“The fact that a claimed compound may be encompassed by a disclosed generic formula does not by itself render that compound obvious”) (emphasis added); *see also, Akzo N.V. v. International Trade Comm’n*, 1 U.S.P.Q.2d 1241, 1245 (Fed. Cir. 1986) (Federal Circuit held a prior art disclosure of “sulfuric acid,” which encompassed “sulfuric acid of at least 98% concentration” did not render obvious claims reciting “sulfuric acid of at least 98% concentration.”). Moreover, “[t]he Federal Circuit has **decline[d]** to extract from *Merck & Co. v. Biocraft Laboratories Inc* . . . the rule that . . . regardless of how broad, a disclosure of a chemical genus renders obvious any species that happens to fall within it.” *In re Jones*, 958 F.2d 347 (Fed. Cir. 1992) (emphasis added).

Rather, to establish a *prima facie* case of obviousness the prior art **must** provide some teaching that would motivate one of ordinary skill in the art to make the proposed modification with a reasonable expectation of success. *See In re Brouwer*, 77 F.3d 422, 425 (Fed. Cir. 1996) (stating that the mere possibility that one of the compounds of the prior art could be modified or replaced so as to read on the claims **does not** make the claims obvious under §103 unless the prior art suggests the desirability of such a modification or replacement) (emphasis added).

Takeuchi also does not cure the deficiencies of Sumiyoshi, the Exxon reference, and Hawley ‘819. Takeuchi is generally drawn to a process of producing α-olefin monomers. *See* Takeuchi, column 2, lines 14-23. Although the reference discloses the general use of α-olefins as synthetic lubricants, plasticizers, and surface active agents,

it is silent with respect to the use of  $\alpha$ -olefins versus non- $\alpha$ -olefins in tire compositions.

See *id.* column 1. Furthermore, while Takeuchi teaches the undisputed fact that  $\alpha$ -olefins are commonly used, it does not teach or suggest that  $\alpha$ -olefins are interchangeable with non- $\alpha$ -olefins in the formation of olefinic resins. Takeuchi also does not teach or suggest that  $\alpha$ -olefins can be used to replace the olefins or the diolefins used to form Escorez 1102. For at least these reasons, Applicants submit that one of ordinary skill at the time the invention was made would not have been motivated by Takeuchi or any of the cited art to modify the composition of Sumiyoshi.

In addition, Applicants respectfully remind the Examiner that Sumiyoshi utilizes the disclosed olefin resin system as a tackifier. See Sumiyoshi, paragraph [0009] (emphasis added). None of the cited references of record teach or even suggest the use of  $\alpha$ -olefin resins for this purpose. At best, Takeuchi discloses the use of  $\alpha$ -olefin resins as lubricants, plasticizers, and surface active agents, as mentioned above. See Takeuchi, column 1, lines 10-15. However, a tackifier is **not** a lubricant, a plasticizer, or a surface active agent. As explained by Hawley's Condensed Chemical Dictionary, 13<sup>th</sup> ed. (1997) (attached), a tackifier is a substance that makes an adhesive stickier. See definition of "tackifier," Hawley's Condensed Chemical Dictionary, page 1070 (1993). In contrast, the term, "lubricant," refers to materials having an antifriction or lubricating effect; the term, "plasticizer," refers to organic compounds added to a polymer to facilitate processing, increase flexibility, and increase toughness of the final product by internal modification; and the term, "surface active agent" refers to any compound that reduces surface tension when dissolved in water or water solutions. See *id.* at 683, 888-89, 1066, respectively. Thus, not only does Takeuchi fail to suggest that  $\alpha$ -olefins

or  $\alpha$ -olefin resins can be substituted for non- $\alpha$ -olefins or non- $\alpha$ -olefin resins, it also fails to suggest using such compounds in the manner required by Sumiyoshi, *i.e.*, as a tackifier.

For at least the foregoing reasons, Applicants submit that the Examiner has failed to meet the burdens necessary to render claims 48, 88, and 94 *prima facie* obvious under § 103(a). Accordingly, the § 103(a) rejection of these claims as unpatentable over Sumiyoshi, the Exxon reference, Hawley's '819, and Takeuchi is improper, and should be withdrawn.

**ii. Claims 49, 83-87, 92, and 93**

With respect to claims 49, 83-87, 92, and 93, Applicants disagree with and traverse the Examiner's position for substantially the same reasons as set forth above in section II(A)(i). That is, irrespective of whether the cited references teach various aspects of these claims, they fail to teach or suggest the use of an  $\alpha$ -olefin, as claimed. Accordingly, the § 103(a) rejection of these claims as unpatentable over Sumiyoshi, the Exxon reference, Hawley's '819, and Takeuchi is improper, and should be withdrawn.

**iii. Claims 51-60**

With respect to claims 51-60, the Examiner alleges that the "Escorez 1102" polymer disclosed by Sumiyoshi meets each of the claimed properties. See Office Action, page 4. Applicants respectfully disagree for substantially the same reasons as set forth above, as well as the following reasons.

As admitted by the Examiner, Sumiyoshi and the Exxon reference "are completely silent" with respect to the use of an  $\alpha$ -olefin polymer. See *id.* at 2. To

address this issue, the Examiner asserted that it would be obvious to modify Sumiyoshi so as to contain an alpha olefin monomer. *See id.* at 2-4.

However, by alleging that it would be obvious to modify Sumiyoshi in the above manner, the Examiner tacitly admits that the disclosed Escorez polymer does not contain an  $\alpha$ -olefin. *See id.* Indeed, as mentioned, the Examiner asserts that it is necessary to modify this compound so as to contain an  $\alpha$ -olefin. *See id.*

Thus, the question in the present case is not whether Escorez 1102 has the claimed properties, but rather whether an Escorez 1102 resin that has been subject to the proposed modification would possess the claimed properties. In this regard, Applicants submit that the Examiner has provided no evidence in support of this assertion, particularly in view of the fact that it is well known that bond position and chemical structure impact polymer properties, and the fact that Escorez 1102 is a composition derived from olefins and diolefins.

With this in mind, the Examiner has not established that an Escorez 1102 resin that has been modified so as to contain the claimed  $\alpha$ -olefin will possess the same properties as unmodified Escorez 1102, much less the claimed properties. Indeed, the Examiner has not even established that the Escorez 1102 resin, when modified as proposed, is capable of functioning as a tackifier, as required by Sumiyoshi. *See In re Gordon*, 733 F.2d 900 (Fed. Cir. 1984) ("If [a] proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification").

Thus, for at least these additional reasons, it is even more clear that the Examiner has failed to meet the burdens necessary to establish a *prima facie* case of

obviousness with respect to claims 51-60. The § 103(a) rejection of these claims is therefore improper, and should be withdrawn.

**iv. Claims 61-72, 75-78, and 90**

With respect to claims 61-72, 75-78 and 90 the Examiner alleges that one of ordinary skill would have found it obvious to employ an  $\alpha$ -olefin having the claimed characteristics (degree of branching, saturation/unsaturation, cyclic moiety substitution). See Office Action, page 4. Applicants respectfully disagree for substantially the same reasons set forth above in section II(A)(i).

That is, Applicants again remind the Examiner that “[t]he fact that a claimed species or subgenus is encompassed by a prior art genus **is not sufficient by itself** to establish a *prima facie* case of obviousness. *In re Baird*, 16 F.3d 380, 382, (Fed. Cir. 1994) (“The fact that a claimed compound may be encompassed by a disclosed generic formula does not by itself render that compound obvious”) (emphasis added). As explained above, the Examiner has not explained *why* one of ordinary skill would pick the  $\alpha$ -olefins of claims 48, 88 and 94, much less the more specific  $\alpha$ -olefins of claims 61-72, 75-78 and 90, from the broad disclosure of the cited references. Thus, the Examiner has not established that the cited references provide the necessary motivation required to establish a *prima facie* case of obviousness.

**B. § 103(a) rejection of claims 81, 82, and 89**

The Examiner also rejects claims 81, 82, and 89 under 35 U.S.C. § 103(a) as being unpatentable over Sumiyoshi, the Exxon reference, Hawley '819, Takeuchi, and further in view of U.S. Patent No. 4,207,218 (“Jorgenson”). Office Action, page 6. Applicants respectfully traverse.

In response, Applicants respectfully disagree with and traverse this rejection for substantially the same reasons set forth above in sections II(A)(i)-(iv). Specifically, while Jorgenson may disclose other aspects of the claimed invention, it does not correct the failure of Sumiyoshi, the Exxon Reference, Hawley '819, and Takeuchi to disclose a tire comprising, *inter alia*, the claimed  $\alpha$ -olefin polymer.

For at least this reason, the § 103(a) rejection of claims 81, 82, and 89 under § 103(a) as being unpatentable over Sumiyoshi, the Exxon reference, Hawley '819, Takeuchi, and Jorgenson is improper, and should be withdrawn.

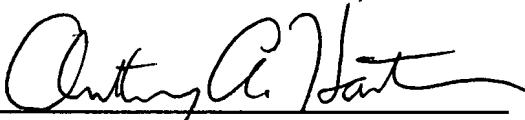
### III. Conclusion

In view of the foregoing remarks, Applicants respectfully request reconsideration of this application and the timely allowance of the pending claims. Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account no. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,  
GARRETT & DUNNER, L.L.P.

Dated: December 4, 2007

By:   
Anthony A. Hartmann  
Reg. No. 43,662

**Attachment:** Hawley's Condensed Chemical Dictionary, 13<sup>th</sup> ed., pages 683, 888-89, 1066, and 1070 (1997)



*Hawley's*

*Condensed Chemical*

*Dictionary*

**THIRTEENTH EDITION**

*Revised by*

Richard J. Lewis, Sr.



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**low explosive.** See explosive, low.

**low-melting alloy.** See alloy, fusible.

**low-pressure resin.** See contact resin.

**low-soda alumina.** Aluminum oxide ( $Al_2O_3$ ) with  $<0.15\%$  sodium oxide content.

**Use:** High-grade electric insulator and other ceramic bodies.

**LOX.** Abbreviation for liquid oxygen, especially when used as a rocket fuel.

**LPG.** Abbreviation for liquefied petroleum gas.

**Lr.** Symbol for element lawrencium.

**LSD.** Abbreviation for lysergic acid diethylamide.

**"L-Selectride" [Aldrich].** TM for lithium tri-sec-butylborohydride, 1.0 molar solution in tetrahydrofuran.  $LiB[CH(CH_3)C_2H_5]_3H$ .

**Properties:** Liquid. Mw 190.11, d 0.890, freezing p -17C. Moisture sensitive. Packaged under nitrogen.

**Hazard:** Pyrophoric, must be handled under inert atmosphere.

**Use:** Reagent for the stereoselective reduction of ketones. Has been used in prostaglandin synthesis.

**LTH.** Abbreviation for luteotropic hormone. See luteotropin.

**Lu.** Symbol for lutetium.

**lube-oil additive.** A chemical added in small amounts to lubricating oils to impart special qualities, such as low pour point when chlorinated hydrocarbons are added. Other special properties include the following:

low viscosity index .....butene polymers  
detergent and  
suspensoid properties.....metallic stearate soaps  
oxidation stability.....calcium stearate  
reduced foaming  
tendency .....silicone compounds  
resistance to high operating  
temperatures .....phosphorus pentasulfide, zinc di-thiophosphate

**lubricant, solid.** A material having a characteristic crystalline habit that causes it to shear into thin, flat plates, which readily slide over one another and thus produce an antifriction or lubricating effect, for example, mica, graphite, molybdenum disulfide, talc, boron nitride.

**lubricant, synthetic.** Any of a number of organic fluids having specialized and effective properties that are required in cases where petroleum-derived

lubricants are inadequate. Each type has at least one property not found in conventional lubricants. Though their cost is much higher, they can be used over a wide range of temperatures and are stable to heat and oxidation. The major types are polyglycols (hydraulic and brake fluids), phosphate esters (fire-resistant), dibasic acid esters (aircraft turbine engines), chlorofluorocarbons (aerospace), silicone oils and greases (electric motors, antifriction bearings), silicate esters (heat-transfer agents and hydraulic fluids), neopentyl polyol esters (turbine engines), and polyphenyl ethers (excellent heat and oxidation resistance, but poor performance at low temperatures). An unusual property of synthetic lubricants is their exceptional resistance to ionizing radiation.

**lubricating grease.** A mixture of a mineral oil or oils with one or more soaps. The most common soaps are those of sodium, calcium, barium, aluminum, lead, lithium, potassium, and zinc. Oils thickened with residuum, petrolatum, or wax may be called greases. Some form of graphite may be added. Greases range in consistency from thin liquids to solid blocks, and in color from transparent to black. The specifications for a grease are determined by the speed, load, temperature, environment, and metals in the desired application. Texture of grease may be smooth, buttery, ropy or stringy, fibrous, spongy, or rubbery. The texture does not necessarily indicate the viscosity of the grease, but is related to the formulation and methods of manufacture.

See lubricating oil.

**lubricating oil.** (lube oil). A selected fraction of refined mineral oil used for lubrication of moving surfaces, usually metallic and ranging from small precision machinery (watches) to the heaviest equipment. Lubricating oils usually have small amounts of additives to impart special properties such as viscosity index and detergency. They range in consistency from thin liquids to greaselike substances. In contrast to lubricating greases, lube oils do not contain solid or fibrous materials.

See porpoise oil; lubricant, synthetic; extreme-pressure additive (2); lube oil additive.

**lubrication.** The introduction of a substance of low viscosity between two adjacent solid surfaces, one of which is in motion (bearing). From an engineering point of view, the chemical nature of the substance is not of critical importance. Thus, materials as diverse as air, water, and molasses could theoretically be used as lubricants under appropriate conditions. Air and water have been used, as well as some solids such as graphite, but in general oils, fats, and waxes are utilized. The ability of a substance to act as a lubricant is sometimes called lubricity.

**lubricity.** See lubrication.

See plasticity.

(2) A high polymer, usually synthetic, combined with other ingredients, such as curatives, fillers, reinforcing agents, colorants, plasticizers, etc.; the mixture can be formed or molded under heat and pressure in its raw state and machined to high dimensional accuracy, trimmed, and finished in its hardened state. The thermoplastic type can be softened to its original condition by heat; the thermosetting type cannot.

Plastics in general (including all forms) are sensitive to high temperatures, among the more resistant being fluorocarbon resins, nylon, phenolics, polyimides, and silicones, though even these soften or melt above 260°C. Other types (cellulosics, polyethylene, acrylic polymers, polystyrene) are combustible when exposed to flame for a short time, and still others (polyurethane) burn with evolution of toxic fumes.

Engineering plastics are those to which standard metal engineering equations can be applied; they are capable of sustaining high loads and stresses and are machinable and dimensionally stable. They are used in construction, as machine parts, automobile components, etc. Among the more important are nylon, acetals, polycarbonates, ABS resins, PPOyrene, and polybutylene terephthalate.

Fibers, films, and bristles are examples of extruded forms. Plastics may be shaped by either compression molding (direct pressure on solid material in a hydraulic press) or injection molding (injection of a measured amount of material into a mold in liquid form). The latter process is most generally used, and articles of considerable size can be produced. Because of their dielectric properties, plastics are essential components of electrical and electronic equipment (especially for use within the human body).

Plastics can be made into flexible and rigid foams by use of a blowing agent; these foams are light and strong, and the rigid type is machinable. They are collectively called cellular plastics. Plastics can also be reinforced, usually with glass or metallic fibers, for added strength. They are laminated to paper, cloth, wood, etc. for many uses in the packaging, electrical, and furniture industries; they also can be metal-plated. Plastic pipe is widely used for underground transportation of gases and liquids over long distances and intraplant.

Several natural materials (waxes, clays, and asphalts) have rheological properties similar to synthetic products, but because they are not polymeric, are not considered true plastics. Certain proteins (casein, zein) are natural high polymers from which plastics are made (buttons and other small items), but they are of decreasing importance.

Plastics have permeated industrial technology. Not only have they replaced and improved upon many materials formerly used, but they also have made possible industrial and medical applications that would have been impracticable with older technol-

ogies. Use of plastics in the U.S. has been authoritatively estimated at close to 60 billion pounds a year in 1980, which is twice the 1970 consumption. Their major application areas are (1) automobile bodies and components, boat hulls; (2) building and construction (siding, piping insulation, flooring); (3) packaging (vapor-proof barriers, display cartons, bottles, drum linings); (4) textiles (carpets, cordage, suiting, hosiery, drip-dry fabrics, etc.); (5) organic coatings (paint and varnish vehicles); (6) adhesives (plywood, reinforced plastics, laminated structures); (7) pipelines; (8) electrical and electronic components; (9) surgical implants; (10) miscellaneous (luggage, toys, tableware, brushes, furniture, etc.).

For additional information refer to The Society of the Plastics Industry, 355 Lexington Ave., New York, NY 10017.

See polymer, high; cellular plastic; reinforced plastic; foam, plastic; plastic pipe. See Appendix III for a history of the industry.

**plastic film.** A thermoplastic film less than 0.022 cm (0.010 inch) in thickness.

**plastic flow.** A type of rheological behavior in which a given material shows no deformation until the applied stress reaches a critical value called the yield value. Most of the so-called plastics do not exhibit plastic flow. Common putty is an example of a material having plastic flow.

**plastic foam.** See foam, plastic; cellular plastic.

**plasticity.** A rheological property of solid or semi-solid materials expressed as the degree to which they will flow or deform under applied stress and retain the shape so induced, either permanently or for a definite time interval. It may be considered the reverse of elasticity. Application of heat and/or special additives is usually required for optimum results.

See thermoplastic; plasticizer.

**plasticizer.** An organic compound added to a high polymer both to facilitate processing and to increase the flexibility and toughness of the final product by internal modification (solvation) of the polymer molecule. The latter is held together by secondary valence bonds; the plasticizer replaces some of these with plasticizer-to-polymer bonds, thus aiding movement of the polymer chain segments. Plasticizers are classed as primary (high compatibility) and secondary (limited compatibility). Polyvinyl chloride and cellulose esters are the largest consumers of plasticizers; they are also used in rubber processing. Among the more important plasticizers are nonvolatile organic liquids and low-melting solids (e.g., phthalate, adipate, and sebacate esters), polyols such as ethylene glycol and its derivatives, tricresyl phosphate, castor oil, etc. Cam-

phor was used in the original modification of nitrocellulose to "Celluloid." See plastisol; softener.

**plastic pipe.** Tubes, cylinders, conduits, and continuous length piping made (1) from thermoplastic polymers unreinforced (polyethylene, polyvinyl chloride, ABS polymers, polypropylene) or (2) from thermosetting polymers (polyesters, phenolics, epoxies) blended with 60-80% of such reinforcing materials as chopped asbestos or glass fibers to increase strength. The latter type is a reinforced plastic. In general the properties of plastic tubing or pipe are those of the polymers that comprise it. Most have good resistance to chemicals, corrosion, weathering, etc., combined with flexibility, light weight, and high strength. They are combustible but generally slow burning. The reinforced type is widely used as underground conduit for transportation of gases and fluids, including city water services, sewage disposal systems, etc. Its use in buildings is subject to local building codes.

For additional information contact Plastic Pipe Institute, 355 Lexington Ave., New York, NY 10017.

**plastic, reinforced.** See reinforced plastic.

**"Plasticryl" [Abco].** TM for emulsion and solvent-based synthetic acrylate polymers.

**Use:** For textile preparation and finishing, in binders, inks, and adhesives.

**"Plat-Iron" [SCM].** TM for high-purity electrolytic iron powder and reduced iron oxide powder, annealed and unannealed.

**Use:** Powder enrichment, catalyst, pole pieces, magnets, electronic cores, welding rod coatings, sintered structural parts, and oilless bearings.

**plastisol.** A dispersion of finely divided resin in a plasticizer. A typical composition is 100 parts resin and 50 parts plasticizer, forming a paste that gels when heated to 150°C as a result of solvation of the resin particles by the plasticizer. If a volatile solvent is included, the plastisol is called an organosol. Plastisols are used for molding thermoplastic resins, chiefly polyvinyl chloride.

See plasticizer.

**"Plast-Manganese" [SCM].** TM for electrolytic manganese powder.

**Use:** Welding rod coatings, pyrotechnics, and fuses.

**"Plast-Nickel" [SCM].** TM for nickel powder.

**Use:** Welding rod coatings, sintered permanent magnets, filters, and parts.

**"Plast-Silicon" [SCM].** TM for silicon powder.

**Use:** Fuses and pyrotechnics.

**plate column.** Distillation column consisting of a number of perforated, equally spaced, horizontal plates on which a layer of liquid is maintained.

**plate efficiency.** (1) The number of theoretical plates that are divided by the number of plates actually used in a tower. (2) Overall plate efficiency refers to the number of equilibrium states necessary for a given separation, divided by the number of actual plates required.

**platelet.** (thrombocyte). A proteinaceous cellular structure occurring in blood in the amount of  $150-500 \times 10^3$  units/mm<sup>3</sup>. Platelets range from 2 to 4  $\mu\text{m}$  in diameter and contain no nuclei. They are rich in amine compounds, which constrict the blood vessels at the site of an injury, to which the platelets adhere; on dissolution they release thromboplastin, which initiates the coagulation mechanism. See blood; fibrinogen; thrombin.

**platen.** A vertically movable plate (deck) of a compression molding press.

See hydraulic press.

**platforming.** The process in which octane ratings of gasoline are raised by dehydrogenating naphthenes to aromatics, cracking high-boiling paraffins, and isomerizing paraffins to form products of greater chain branching. Desulfurization also takes place in this process.

**platinic.** Refers to compounds containing tetravalent platinum.

**platinic ammonium chloride.** See ammonium hexachloroplatinate.

**platinic chloride.** See chloroplatinic acid, platinum chloride.

**platinic oxide.** See platinum dioxide.

**platinic sal ammoniac.** See ammonium hexachloroplatinate.

**platinic sodium chloride.** See sodium chloroplatinate.

**platinic sulfate.** See platinum sulfate.

**platinous ammonium chloride.** See ammonium chloroplatinate.

**platinous chloride.** See platinum dichloride.

**platinous iodide.** See platinum iodide.

**platinum.**

CAS: 7440-06-4. Pt. Metallic element of atomic number 78, group VIII of the periodic table, aw. 195.09, valences of 2, 4. There are five stable isotopes.

**surface**, but it also includes dispersions involving only one phase of matter, i.e., solid-solid or liquid-liquid.

See interface; surface area; surface chemistry.

**surface-active agent.** (surfactant). Any compound that reduces surface tension when dissolved in water or water solutions, or that reduces interfacial tension between two liquids, or between a liquid and a solid. There are three categories of surface-active agents: detergents, wetting agents, and emulsifiers; all use the same basic chemical mechanism and differ chiefly in the nature of the surfaces involved.

See interface; surface chemistry.

**surface area.** The total area of exposed surface of a finely divided solid (powder, fiber, etc.) including irregularities of all types. Since activity is greatest at the surface, that is, the boundary between the particle and its environment, the larger the surface area of a given substance, the more reactive it is. Thus reduction to small particles is a means of increasing the efficiency of both chemical and physical reactions; for example, the coloring effect of pigments is increased by maximum size reduction. Carbon black is notable among solids for its huge surface area (as much as 18 acres/lb for some types); the activity of its surface accounts for its outstanding ability to increase the strength and abrasion resistance of rubber. The capacity of activated carbon to adsorb molecules of gases is due to this factor. Surface area is measured most accurately by nitrogen adsorption techniques.

**surface chemistry.** The observation and measurement of forces acting at the surfaces of gases, liquids and solids or at the interfaces between them. This includes the surface tension of liquids (vapor pressure, solubility); emulsions (liquid-liquid interfaces); finely divided solid particles (adsorption, catalysis); permeable membranes and microporous materials; and biochemical phenomena such as osmosis, cell function, and metabolic mechanisms in plants and animals. Surface chemistry has many industrial applications, a few of which are air pollution, soaps and synthetic detergents, reinforcement of rubber and plastics, behavior of catalysts, color and optical properties of paints, aerosol sprays of all types, monolayers and thin films, both metallic and organic. Outstanding names in the development of this science are Graham, Freundlich, and W. Ostwald in the 19th Century, and Harkins, Langmuir, LaMer, and McBain in the 20th.

See colloid chemistry.

**surface tension.** In any liquid, the attractive force exerted by the molecules below the surface upon those at the surface-air interface, resulting from the high molecular concentration of a liquid compared to the low molecular concentration of a gas. An inward pull, or internal pressure, is thus created

which tends to restrain the liquid from flowing. Its strength varies with the chemical nature of the liquid. Polar liquids have high surface tension (water = 73 dynes/cm at 20°C); nonpolar liquids have much lower values (benzene = 29 dynes/cm, ethanol = 22.3 dynes/cm), thus they flow more readily than water. Mercury, with the highest surface tension of any liquid (480 dynes/cm) does not flow, but disintegrates into droplets.

See interface; surface-active agent.

**surfactant.** See surface-active agent.

**“Sur-Gard” [Nalco].** TM for chemicals used for treatment of boiler water to inhibit scale and corrosion and to remove oxygen from the boiler water.

**“Surlyn” [Du Pont].** TM for a group of ionomer resins.

**Properties:** (“Surlyn” A) Thermoplastic produced as a granular material; flexible, transparent, grease resistant; very light weight but tough. Izod impact strength 5.7–14.6 ft-lb/in (higher than any other polyolefin), tensile strength 3,500–5,500 psi, elongation 300–400%, softening point 71. Insoluble in any commercial solvent. Subject to slow swelling by hydrocarbons, to slow attack by acids.

**Use:** Coatings, packaging films, products made by injection or blow molding, or by thermoforming.

**SUS.** Abbreviation for Saybolt Universal Seconds. See Saybolt Universal viscosity.

**suspension.** A system in which very small particles (solid, semisolid, or liquid) are more or less uniformly dispersed in a liquid or gaseous medium. If the particles are small enough to pass through filter membranes, the system is a colloidal suspension (or solution). Examples of solid-in-liquid suspensions are comminuted wood pulp in water, which becomes paper on filtration; the fat particles in milk; and the red corpuscles in blood. A liquid-in-gas suspension is represented by fog or by an aerosol spray. If the particles are larger than colloidal dimensions they will tend to precipitate if heavier than the suspending medium, or to agglomerate and rise to the surface if lighter. This can be prevented by incorporation of protective colloids. Polymerization is often carried out in suspension, the product being in the form of spheres or beads. See solution; colloidal; dispersion; emulsion; colloid chemistry.

**“Sustane” [UOP].** TM for synthetic, food-grade antioxidant product line including BHA, BHT, TBHQ, propyl gallate, and liquid blends.

**Use:** To preserve vegetable oils, animal fats, spices, baked goods, nuts, pet foods, dressing oils, confections, cereals, sausage, cosmetics, and dehydrated potatoes.

# T

**T.** Symbol for tritium, also for tera-

**2,4,5-T.** Abbreviation for 2,4,5-trichlorophenoxyacetic acid.

**2,4,6-T.** Abbreviation for 2,4,6-trichlorophenol.

**Ta.** Symbol for tantalum.

**tabun.** (dimethylphosphoramidocyanidic acid, ethyl ester).

CAS: 77-81-6.  $(CH_3)_2NP(O)(C_2H_5O)(CN)$ . A nerve gas.

**Properties:** Liquid. Fp -50C, bp 240C, flash p 172F (77.7C), d 1.4250 (20/4C). Readily soluble in organic solvents; miscible with water but readily hydrolyzed; destroyed by bleaching powder, generating cyanogen chloride. Combustible.

**Hazard:** Very toxic by inhalation, cholinesterase inhibitor, a military nerve gas, fatal dose (man) 0.01 mg/kg.

**"TAC" [Mallinckrodt].** TM for tested additive chemical items, satisfactory for food additives and medical uses.

**tachysterol.**  $C_{28}H_{44}O$ .

**Properties:** Oil; levorotatory. Insoluble in water; soluble in most organic solvents. Protect from air. **Use:** Medicine, as the dihydrotachysterol.

**tackifiers.** Refers to compounds used for making an adhesive stickier.

**tackiness.** (tack).

Property of being sticky or adhesive.

**taconite.** A low-grade iron ore consisting essentially of a mixture of hematite and silica. It contains 25% iron. Found in the Lake Superior district and western states.

**tacticity.** The regularity or symmetry in the molecular arrangement or structure of a polymer molecule. Contrasts with random positioning of substituent groups along the polymer backbone, or random position with respect to one another of successive atoms in the backbone chain of a polymer molecule.

See polymer, stereospecific; isotactic.

**Tafel rearrangement.** Rearrangement of the carbon skeleton of substituted acetoacetic esters to hydrocarbons with the same number of carbon atoms

by electrolytic reduction at a lead cathode in alcoholic sulfuric acid.

**Tag Closed Cup.** See TCC.

**tagetes.** A permissible food additive used to increase the yellow color of the skin and eggs of poultry. It is made from the petals of the Aztec marigold (*Tagetes erecta* L.), either ground to a meal or extracted with hexane, with addition of up to 0.3% ethoxyquin.

**tagged atom.** A radioactive isotope used in tracing the behavior of a substance in both biochemical and engineering research, e.g., C-14 or I-131. See tracer; label (2).

**Tagliabue Closed Cup.** A standard method of determining flash points.

**Tagliabue Open Cup.** A standard method of determining flash points.

**Tag Open Cup.** See Tagliabue Open Cup.

**tailings.** (1) In flour milling, the product left after grinding and bolting middlings. (2) Impurities remaining after the extraction of useful minerals from an ore. (3) In general, any residue from a mechanical refining or separation process.

**tailored molecule.** A molecule that has been modified chemically to give it certain properties.

**tails.** Refers to high-boiling impurities that are less volatile than the solvent being distilled.

**talc.** (talcum; soapstone; steatite).

CAS: 14807-96-6.  $Mg_3Si_4O_{10}(OH)_2$  or  $3MgO \cdot 4SiO_2 \cdot H_2O$ . A natural hydrous magnesium silicate. Compact, massive varieties may be called steatite in distinction from the foliated varieties, which are called talc. Soapstone is an impure variety of steatite.

**Properties:** White, apple-green, gray powder; pearly or greasy luster, greasy feel. Mohs hardness 1-1.5 (may be harder when impure), high resistance to acids, alkalies and heat; d 2.7-2.8.

**Grade:** Crude, washed, air-floated, USP, fibrous (99.5%, 99.95%).

**Hazard:** Toxic by inhalation. TLV (soapstone) 6 mg/m<sup>3</sup>; respirable dust 3 mg/m<sup>3</sup> in air; (talc containing no asbestos): 2 mg/m<sup>3</sup> respirable dust in air.

**Use:** Ceramics; cosmetics and pharmaceuticals; filler in rubber, paints, soap, putty, plaster, oilcloth;